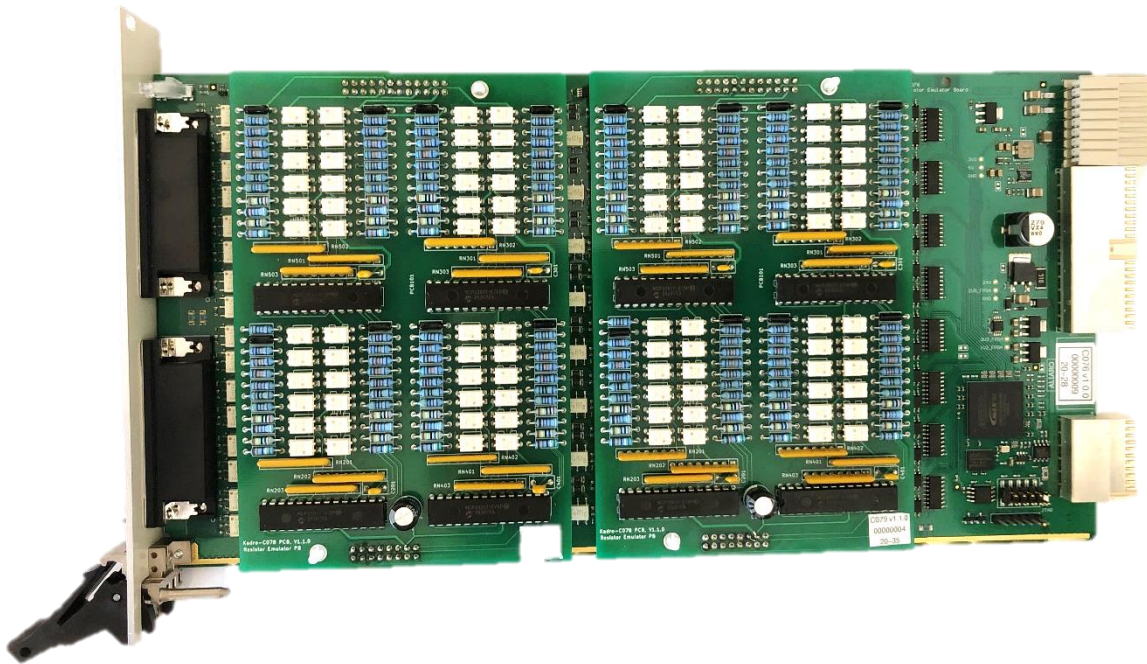# 16 Channel Resistor Emulation Board

AL-3011 for SLSC

This document describes how to get started with the SLSC Resistor Emulator for National Instruments SLSC-12001 chassis.

Definitions

Warranted specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

The following characteristic specifications describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- Typical specifications describe the performance met by a majority of models.
- Nominal specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are *Typical* unless otherwise noted.

Conditions

Specifications are valid under the following conditions unless otherwise noted.

The AL-3011 board is mounted in an SLSC chassis with the recommended cooling clearances and using a power supply that meets the specifications provided in the chassis user guide. For the entire temperature range of the chassis.

Note These specifications only apply to the product as provided by Aliaro. Modifications to the module may invalidate these. Be certain to verify the performance of modified modules.

Caution Observe all instructions and cautions in the user documentation. Using the model in a manner not specified can damage the model and compromise the built-in safety protection. Return damaged models to Aliaro for repair.

Content

Electromagnetic Compatibility

This product is intended for use in industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any modifications to the product not expressly approved by Aliaro could void your authority to operate it under your local regulatory rules.

> ⚠ **Caution** To ensure the specified EMC performance, operate this product only with shielded cables and accessories.

Safety

> ⚠ **Caution** Observe all instructions and cautions in the user documentation. Using the model in a manner not specified can damage the model and compromise the built-in safety protection. Return damaged models to Aliaro for repair.

Environmental Characteristics

Temperature and Humidity

Operating temperature:	0 °C to 40 °C
Storage temperature range:	-40 °C to 85 °C
Operating relative humidity range:	10% to 90%, noncondensing
Storage relative humidity range:	5% to 95%, noncondensing
Pollution degree:	2
Maximum altitude:	2,000 m (800 mbar)(at 25 °C ambient)
Note: Indoor use only	

Unpacking the module

Carefully inspect the shipping container and the module for damage. Check for visible damage to the exterior and interior of the damage. If damage appears to have been caused during shipment file a claim with the carrier. Retain the packing material for possible inspection and/or reshipment. If the chassis is damaged, do not install it and contact Aliaro.

Aliaro reserve the right to vary from the description given in this data sheet and shall not be liable for any errors.

www.aliaro.com

Overview

The AL-3011 is a 16-channel high accurate and wide range resistor emulation board for applications requiring simulation of resistive sensors.

The AL-3011 is designed for the National Instruments (NI) Switch Load Signal Conditioning (SLSC) system, to be used in Hardware-In-the-Loop (HIL) simulators.

The board interfaces NI PXI and/or Compact-RIO instrumentation devices for the purposes of developing, verifying, and validating electronic control unit software and hardware.
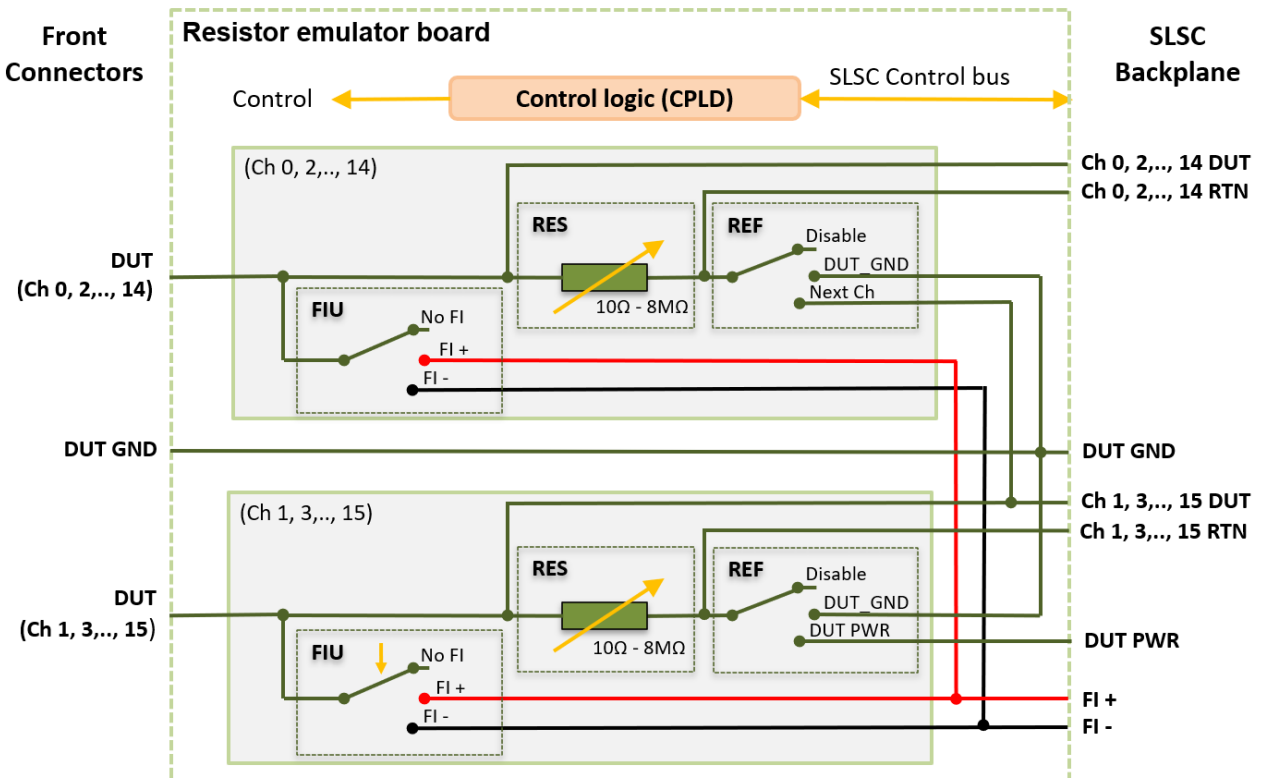

Figure 1, Block diagram

The resistance (RES) can be set to 10Ω -8MΩ for each channel

Fault insertion (FIU) is available on each channel providing short to FI+ or to FI –

The reference (REF) of each channel can be set to:
- Disabled (for fault insertion/open circuit)
- Connected to DUT_GND.
- Connected to DUT_PWR for 8 of the channels (odd nr), see figure above
- Connected to Next channel for 8 of the channels (even nr), see figure above

ALIARO

Application

- ✓ Sensor and actuator emulation such as temperature and pressure
- ✓ Fault insertion i.e. validation of faulty wiring or corrupt sensors

Features

- ✓ 16 independent and isolated channels with resistor emulation
- ✓ Two common reference buses
- ✓ Brake up, short to + and - for each channel
- ✓ Wide resistance range
- ✓ LabVIEW driver included
- ✓ Custom Device Driver for VeriStand included

Specifications

Parameter	Range	Value
Max Voltage		60 V
Max Current		100mA
Max Power		400mW
Range		10 Ω to 8 MΩ
Resolution		0,5 Ω
Overall Accuracy @ 20 - 40 °C	10-100Ω	<5 %
	100 – 2kΩ	<0,5 %
	2kΩ – 100kΩ	<0.2 %
	100kΩ – 1.5MΩ	<0,5 %
	1.5MΩ – 8MΩ	<2 %
Calibration	The card has an open calibration feature meaning that the customer has access to this feature and can use it for system calibration as well.	

* The accuracy of the module can be tuned for customer application to achieve higher accuracy.

What You Need to Get Started

To set up and use the module you need the following items:

Hardware

- SLSC-12001 chassis
- SLSC module(s)
- NI RTI backplane
- Power cable
- Power input connector
- Grounding wire
- Grounding lug

Tools

- Screwdriver as needed for your application
- Wire stripper

Documentation

- SLSC-12001 Chassis Getting Started Guide and Specifications

Installing the AL-3011

1. Caution Do not touch the contacts or remove the I/O boards or cables while the system is energized.

2. Power off the main DC power source or disconnect the power source from the chassis before installing any modules or RTIs.

3. Ensure that the chassis is powered off. The POWER LED should be off. If the POWER LED is not off, do not proceed until it is off.

   Notice SLSC chassis and AL-3011 board do not support hot plug-in.
   The entire chassis must be powered off when a module is inserted or removed.

4. Loosen the screws on the upper rear panel of the chassis.

5. Position the RTI backplane at the desired slot and insert the securing screws, but do not fully tighten them.

6. Insert the AL-3011 module into the same slot as its corresponding RTI while firmly holding the RTI in place until the RTI is firmly connected to the module.

7. Repeat steps 4 and 5 for all required RTIs.

8. Fully tighten the screws for all RTIs and the upper rear panel of the chassis. Note Waiting until all RTIs and modules are installed to fully tighten the screws ensures proper alignment for future connections between modules and RTIs.

9. Fully tighten the two module mounting screws on each newly installed module.

10. Power on the SLSC chassis

Getting Started with Software

Install the following applications to get fully potential of the functionalities:

- AL-3011 Custom Devices
    - Supplied by ALIARO AB
- National Instrument software
    - SLSC Driver
    - Drivers for VeriStand & HW
    - LabVIEW
    - Version 2018 or higher

Connector locations

Figure 2; Board connectors

Connector pinout - Connector J1

This connector is used for interfacing the test object.

In general all 16 channels are input through this connector with the same pinout as the SLSC-12201 module provided by National Instruments (http://www.ni.com/pdf/manuals/377035b.pdf).

Connector pinout - Connector J2

This connector is only used as a forward connector meaning all pins in the J1 connector will be routed to this connector.

By doing like this the channels may be used for other purposes as well in the SLSC system.
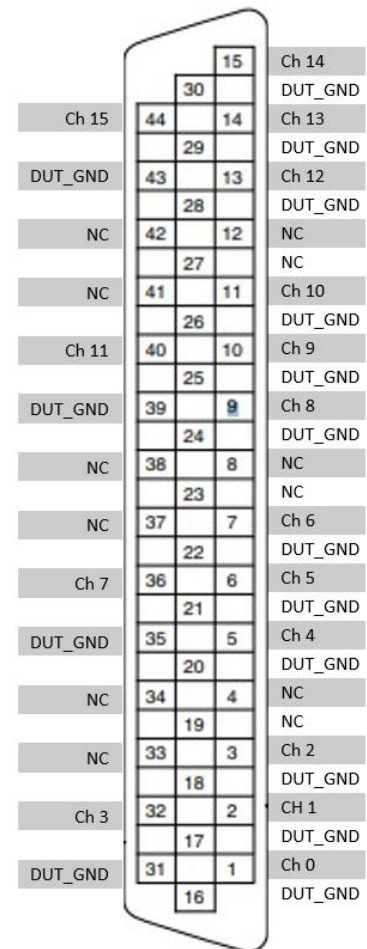

Figure 3, J1 & J2 Pinout

Connector pinout - Connector XJ3

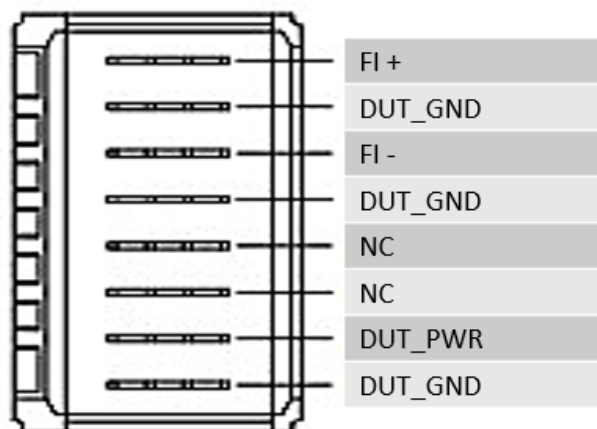This connector will use the predefined setting as sued in the SLSC-12201 module.

Figure 4, XJ3 Pinout

Connector pinout - Connector XJ2

All resistor channels are available thru the backplane, see figure above.
The pinout matches NI RTI backplanes.

| Row	A	B	C	D	E	F
1	Ch 0 DUT	Ch 0 RTN	N.C	Ch 2 DUT	Ch 2 RTN	DUT GND
2	Ch 4 DUT	Ch 4 DUT	N.C	Ch 6 DUT	Ch 6 RTN	DUT GND
3	DUT GND	DUT GND	DUT GND	DUT GND	DUT GND	DUT GND
4	Ch 8 DUT	Ch 8 RTN	N.C	Ch 10 DUT	Ch 10 RTN	DUT GND
5	Ch 12 DUT	Ch 12 DUT	N.C	Ch 14 DUT	Ch 14 RTN	DUT GND
6	DUT GND	DUT GND	DUT GND	DUT GND	DUT GND	DUT GND
7	Ch 1 DUT	Ch 1 RTN	N.C	Ch 3 DUT	Ch 3 RTN	DUT GND
8	Ch 5 DUT	Ch 5 DUT	N.C	Ch 7 DUT	Ch 7 RTN	DUT GND
9	DUT GND	DUT GND	DUT GND	DUT GND	DUT GND	DUT GND
10	Ch 9 DUT	Ch 9 RTN	N.C	Ch 11 DUT	Ch 11 RTN	DUT GND
11	Ch 13 DUT	Ch 13 DUT	N.C	Ch 15 DUT	Ch 15 RTN	DUT GND
15	N.C	N.C	N.C	N.C	N.C	DUT GND
16	N.C	N.C	N.C	N.C	N.C	DUT GND
17	DUT GND	DUT GND	DUT GND	DUT GND	DUT GND	DUT GND
18	N.C	N.C	N.C	N.C	N.C	DUT GND
19	N.C	N.C	N.C	N.C	N.C	DUT GND
20	DUT GND	DUT GND	DUT GND	DUT GND	DUT GND	DUT GND
21	N.C	N.C	N.C	N.C	N.C	DUT GND
22	N.C	N.C	N.C	N.C	N.C	DUT GND
23	DUT GND	DUT GND	DUT GND	DUT GND	DUT GND	DUT GND
24	N.C	N.C	N.C	N.C	N.C	N.C
25	N.C	N.C	N.C	N.C	N.C	N.C
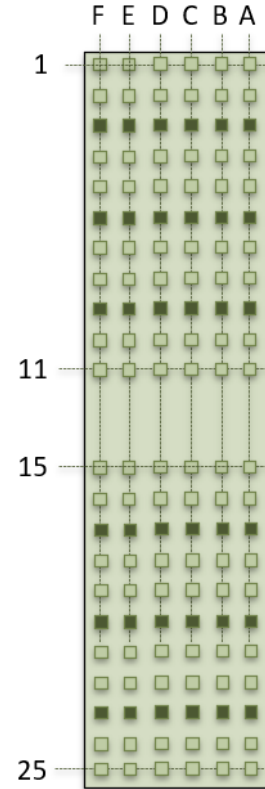
Table 1, CJ2 pinout

Design Standards and Compatibility

Switch Load and Signal Conditioning Module Design Specifications Version	1.4
SLSC Compliance Level	1
Rear I/O Compatibility Category	1
Required RTI	Any Compliance Level 1
Earliest driver version	NI-SLSC 18.6

Accessories

Visit **aliaro.com** for more information about AL-3011 accessories. You must install mating connectors according to local safety codes and standards and according to the specifications provided by the manufacturer.

You are responsible for verifying the safety compliance of third-party connectors and their usage according to the relevant standard(s).

Calibration

Recommended warm-up time	1 hour
Calibration interval	2 years

Physical Characteristics

SLSC slots	1
Dimensions	144.32mm x 30.48mm x 281 mm (H x W x D)
Weight	560 gram
Front I/O Connector	2 x DSUB44
Rear I/O Connectors	1x 110-pin Hard Metric Type A, 1x 8-blade Universal Power Module (UPM), capable of implementing Fully Compatible Rear I/O

Safety Guidelines

Cautions

Ensure that hazardous voltage wiring is performed only by qualified personnel adhering to local electrical standards.

Do not mix hazardous voltage circuits and human-accessible circuits on the same module

When device terminals are hazardous voltage LIVE, you must ensure that devices and circuits connected to the device are properly insulated from human contact.

All wiring must be insulated for the highest voltage used.

Product Certifications and Declarations

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information.

To obtain product certifications and the DoC for Aliaro products, visit **aliaro.com/certification.**

CE Compliance

This product meets the essential requirements of applicable European Directives, as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 2011/65/EU; Restriction of Hazardous Substances (RoHS)

Electromagnetic Compatibility Standards

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

EN 55011-2009 Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement CISPR 11:2009

EN 55032:2012 Electromagnetic compatibility of multimedia equipment - Emission requirements CISPR 32:2012

EN 61326-1-2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements IEC 61326-1:2012

FCC Regulations Title 47 Chapter 1, Part 15, Subpart B, Class B.
§15.107: Conducted Emission, AC power line, §15.109: Radiated Emission

Aliaro reserve the right to vary from the description given in this data sheet and shall not be liable for any errors.

www.aliaro.com

Environmental Management

Aliaro is committed to designing and manufacturing products in an environmentally responsible manner. Aliaro recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to Aliaro customers. For additional environmental information, refer to the Minimize Our Environmental Impact web page at **aliaro.com/environment.**

This page contains the environmental regulations and directives with which Aliaro complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all Aliaro products must be disposed of according to local laws and regulations.

For more information about how to recycle Aliaro products in your region, visit **aliaro.com/environment/weee**

Aliaro reserve the right to vary from the description given in this data sheet and shall not be liable for any errors.

www.aliaro.com